DOCUMENT RESUME

ED 427 065 TM 029 446

AUTHOR	Liu, Yuxiang
TITLE	Educational Stock and Economic Output: A Quantitative Analysis.
PUB DATE	1998-00-00
NOTE	23p.
PUB TYPE	Reports - Evaluative (142)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Economic Factors; Economic Impact; *Educational Attainment; Educational Economics; Graduate Study; Higher Education; Human Capital; Income; *Outcomes of Education; Productivity; *Professional Education
IDENTIFIERS	*Gross State Product; Variance (Statistical)

ABSTRACT

A series of multiple linear regressions analyses was used to investigate the relationship between educational stock and economic output. The gross state product (GSP) per capita was used as the dependent variable. Used as independent variables were percentages of: (1) state residents with a high school diploma and above; (2) state residents with any kind of higher education; (3) state residents with an associate degree and above; (4) state residents with a bachelor's degree and above; and '5) state residents with a graduate or professional degree. Results of the multiple linear regression analyses indicate that there is a significant linear relationship, at the 0.05 level, between GSP per capita and each of the five independent variables. Results of the multiple linear regression analyses also indicate that about 19% of the variance in GSP per capita can be explained by percentage of state residents with a high school diploma and above, and about 21% of the variance in GSP per capita can be explained by the percentage of state residents with any type of higher education. About 25% of the variance in GSP per capita can be explained by the percentage of state residents with an associate degree and above, and about 40% of the GSP per capita can be explained by the percentage of state residents with a bachelor's degree and above. The percentage of state residents with a graduate or professional degree explains about 50% of the variance in GSP per capita. (Contains 7 tables and 23 references.) (Author/SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 427 065

Educational Stock and Economic Output: A Quantitative Analysis

Yuxiang Liu

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Liu, Yuxiang

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

TM029446

Center for Research on Teachig and Learning
College of Education
University of Arkansas at Little Rock

1998

BEST COPY AVAILABLE

ABSTRACT

A series of multiple linear regression analyses were used to investigate the relationship between educational stock and economic output. The gross state product (GSP) per capita was used as the dependent variable. Used as the independent variables were: (a) the percentage of state residents with a high school diploma and above, (b) the percentage of state residents with any level of higher education, (c) the percentage of state residents with an associate degree and above, (d) the percentage of state residents with a bachelor's degree and above, and (e) the percentage of state residents with a graduate or professional degree.

The results of the multiple linear regression analyses indicate that there is a significant linear relationship, at the .05 level, between GSP per capita and each of the five independent variables. The results of the multiple linear regression analyses also indicate: (a) about 19% of the variance in GSP per capita can be explained by the percentage of state residents with a high school diploma and above, (b) about 21% of the variance in GSP per capita can be explained by the percentage of state residents with any level of higher education, (c) about 25% of the variance in GSP per capita can be explained by the percentage of state residents with an associate degree and above, (d) about 40% of the variance in GSP per capita can be explained by the percentage of state residents with a bachelor's degree and above, and (e) about 50% of the variance in GSP per capita can be explained by the percentage of state residents with a graduate or professional degree.

Educational Stock and Economic Output: A Quantitative Analysis

Yuxiang Liu
University of Arkansas at Little Rock

Introduction

In a world where quick and easy answers are sought, there has been constant concern about the quality and the value of education. Critics of education have denigrated its value. Whether education is viewed as a promoter of human development or as an investment in human capital, the issues surrounding the worth of education are too urgent and too costly to be left to chance. The consequence of failing to examine these issues is to continue an uninformed dialogue about its worth.

As projected by U.S. Department of Education (1993), about 66.7 million students would be enrolled in U.S. elementary, secondary, and higher educational institutions in the fall semester of 1996--approximately a quarter of the whole population of the United States. Of the 66.7 million, over 14 million would be enrolled in higher educational institutions (p. 12). How did the enterprise of education attract so many customers?

According to U.S. Department of Education (1993), the total expenditure of educational institutions was $466 billion for the 1992-93 fiscal year--about 7.8% of the gross domestic product (p. 36). Why is so much money from the public purse spent on education? Does education return to society as much as is spent on it or is it a social service agency? What is the relationship between education and the economy?

Public money is part of the spending on education. Individual students also spend a considerable amount on their education. According to The Chronicle of Higher Education (Sept. 2, 1996), for the 1994-95 academic year the average tuition and fees were $2,689 at public four-year higher educational institutions and $11,522 at private four-year higher educational institutions (p. 10). According to the National Association of State Universities and Land-Grant Colleges (1996), in fiscal year 1992 students at Ohio's public universities spent some $1.3 billion on off-campus expenses such as housing, food, and transportation (p. 2). Do individuals spend so much money on their education because they expect that returns on their investment will benefit themselves and their families? Do they unquestioningly accept the worth of higher education? Do they ever think of any alternative investments?

The facts and questions presented above may lead to the assumption that education is important to both individuals and society because it attracts so many people and both individuals and society are spending so much on it. The importance of education, however, is sometimes overlooked by parents who are facing rising tuition bills and by legislators who are looking for ways to cut spending on education when facing ever increasing demands.

If it is important to keep the enterprise of education going and perhaps, to make it more prosperous, appropriate answers to the questions raised above need to be found. Answers need to be given to parents, employers, taxpayers, legislators, and government leaders as to the role that education plays in daily activities and in economic development. Evidence needs to be presented to show whether education has any impact on the economy.

Economists and educators have spent much time and effort identifying the impact of education on economic development. Human capital theory has been used as a basis for the analysis of the relationship between education and the economy.

According to human capital theory, part of the variance in productivity can be explained by the labor quality in terms of education and training received by the work force. Investment in education leads to higher productivity, and higher productivity, in turn, causes higher earnings (Cohn & Geske, 1990, p. 34).

Human capital theory has helped economists and educators explain the economic residual, calculate the costs of education, and compute the returns to society. Studies based on human capital theory have been carried out in such areas as the relationship between school enrollment and the gross domestic product, and the relationship between educational expenditures and the gross domestic product.

From their studies, economists and educators have found much evidence to show the impact of education on economic development. This study is intended to contribute evidence to the literature on human capital theory. The focus of this study is on the relationship between educational stock and economic output.

Human Capital Theory

What is the relationship between education and the economy? This question is not new today, and according to Woodhall (1987), the question was

not new three decades ago either (p. 1). He believed that the question had a much longer history. The systematic study of this question, he noted, however, did not start until the 1960s when a branch of economic theory called the economics of education began to develop rapidly. Woodhall listed such topics in the study of the economics of education as the contribution of education to economic growth, the profitability of investment in education, the role of educated manpower in economic development, the costs of education, the finance of education, and the effects of education on the distribution of income and wealth. The concept of human capital, he pointed out, was "central to much of the research in the economics of education".

The Human Capital Revolution

Many economists and educators (e.g., Wykstra, 1971, and Woodhall, 1987) have agreed that the treatment of human beings as a capital component is by no means a novel idea. Woodhall (1987) quoted a message from The Wealth of Nations by Adam Smith (1776): "A man educated at the expense of much labor and time ... may be compared to one of those expensive machines" (p. 1). Woodhall also noted that in 1924 the Russian economist Strumilin "drew analogies between investment in education and investment in physical capital" (p. 1).

While accepting the fact that the idea of the treatment of human beings as a capital component came from the classical economists, many contemporary economists have pointed out that the concept of human capital was not applied seriously until the 1960s. In his Human Capital, Becker (1993) said that "what has been called the human capital 'revolution' began about three decades ago" (p. 15). Wykstra (1971) argued that although the idea of the treatment of human beings as a capital component was in the literature of the classical economists, "the discipline of economics failed to incorporate fully the human capital component into the stream of economic thought" (p. 2). He noted that "the prevailing tradition among economists remained that of recognizing only the standard factors of production--labor and physical capital" (p. 3). Cohn (1975) wrote that "while the importance of human capital was recognized by most writers, few had come to accept human capital as 'wealth' in the same sense that material capital was used" (p. 30).

What initiated the human capital "revolution"? Becker (1993) believed that it was the attempt of economists to "remove a little of the mystery from the economic and social world that we live in" (p. 25). Davis and Morrall

(1974) identified the mystery as the mystery of the economic residual. They defined the economic residual as follows:

> Studies of the sources of, or contributions to, economic growth usually begin by trying to measure the effect on national income of increments in resources and of improvements in their quality and use. The part of an increase in national income that is not "explained" statistically by increments in labor and physical capital is called the "residual." (p. 69)

Schultz (1971) stated that human capital contributed much "in solving the long-standing puzzle of the residual, where the rate of increase in outputs exceeds the rate of increase in inputs" (p. 161). He also pointed out that human capital had grown in Western societies at a much faster rate than nonhuman capital, and that increases in national output had been large compared with man-hours and physical capital. He stated that "investment in human capital is, probably, the major explanation for this difference" (p. 24).

DeYoung (1989) wrote that "according to human capital theorists, the explanation of a large part of the residual variance in economic growth lay in the increasing skill base of workers within modern economies" (p. 123).

Following the human capital "revolution" in the 1960s have been broad publications on human capital and investment in human capital. Weisbrod (1971) pointed out that capital could exist in intangible form as well as tangible form. By capital in tangible form he meant factories and machines, and by capital in intangible form he meant the capital embodied in people--a combination of labor and capital. He called this combination "human capital." He argued that "studies of the sources of economic growth that have measured only changes in the stock of physical capital (plant and equipment) have been incomplete; they have neglected the growing investment in human capital" (p. 70).

Regarding the question of what kinds of investment are investments in human capital, many economists and educators have given similar answers. The forms that Becker (1993) listed as investments in human capital included schooling, a computer training course, expenditures on medical care, and lectures on the virtues of punctuality and honesty. He noted that all these forms of investment could improve health, raise earning, or add to a person's appreciation of literature over much of his or her lifetime.

Schultz (1971) identified a unique characteristic of education (as a form of human investment). He pointed out that education was more durable than most other forms of human capital: "A high school education may serve the person over the rest of his life, and of this period, 40 years or more are likely to be in productive work" (p. 123). He also noted that education could be augmented because of its durability: "The fact that it has a relatively longer life means that a given gross investment adds more to the stock than the same gross investment typically adds to the stock of nonhuman capital" (p. 123).

In analyzing the role that education has played in the development of economy, economists and educators have not only confirmed the function of education in economic growth theoretically but also have done a lot of empirical analyses.

Empirical Analysis Based on Human Capital Theory

A variety of approaches have been employed to test human capital theory. These approaches include the relationship analysis approach, the residual approach, and the cost benefit approach.

The relationship analysis approach has mainly focused on comparing the incomes of individuals with different levels of education. According to DeYoung (1989), individuals with higher levels of education typically have higher status jobs, and the more education an individual receives, the higher his salaries and lifetime earnings tend to be.

The residual approach analyzes the relationship between education and the economy by finding out the residuals that cannot be explained statistically by increment of labor and physical capital. Schultz (1961) compared the real income of the United States in 1929 with that in 1957. He found a residual of 71 billion dollars that could not be explained statistically by increments of labor and physical capital. Then he compared the total value of the educational stock in 1957 with that in 1930, and found an increase of 286 billion dollars during that period. Using three different estimates of the return, he obtained three different estimates of the percentage of the residual that could be explained by the increase in the educational stock. His three estimates were 36, 44, and 70 percent. That was, from 1929 to 1957 between 36 and 70 percent of the increase in labor income could be explained by the increase in the educational stock.

The cost benefit approach investigates the relationship between education and the economy by calculating the internal rate of return. Scholars (e.g., Becker, 1993, and Psacharopoulos, 1981) have found that both the private and social rates of return to investment in education, in most cases, are above the 10% common yardstick of the opportunity cost of capital.

Using the 1940 and 1950 censuses, Becker (1993) derived the private and social rates of return to the 1939 cohort of urban, native white, male college graduates and the 1949 cohort of white male college graduates. The private rate of return was 14.5% to the 1939 cohort and 13% to the 1949 cohort. The social rate of return was 13% to the 1939 cohort and 12.5% to the 1949 cohort.

In a study on returns to education at the international level, Psacharopoulos (1981) presented private and social rates of return by educational level in 44 countries. He found four patterns in the results of his study: (a) the returns to primary education (whether social or private) are the highest among all educational levels, (b) the private returns are in excess of social returns, especially at the university level, (c) all rates of return to investment in education are well above the 10% common yardstick of the opportunity cost of capital, and (d) the returns to education in developing countries are higher relative to corresponding returns in more advanced countries.

Critique of the Human Capital Theory

The literature of human capital theory reveals that economists and educators have confirmed the important role that education plays in the economic development. Some, however, have presented the limitations and weaknesses of the human capital theory.

Merrett (1971) mentioned some minor difficulties in calculating the rate of return to education. These difficulties include the measurement of student opportunity costs, and the exclusion of expenditures on residential accommodation, research, and consumption activities from the cost estimate.

While accepting it as a fact that education makes changes in individuals, Solmon (1987) raised the question of the extent to which the changes are the result of schooling. He argued that such factors as maturation and noneducational experiences may also contribute to the changes.

Problem Statement and Research Questions

The problem of this study was to investigate the strength of the relationship between educational stock and economic output. Educational stock was measured in terms of the percentage of state residents with different levels of education. The gross state product (GSP) was used as the indicator of economic output.

Specifically, this study was intended to seek answers to the following questions by regressing GSP per capita on the percentage of state residents with different levels of education.

A. Is there a statistically significant linear relationship, at the .05 level, between GSP per capita and the percentage of state residents with a high school diploma and above? If there is, how much of the variance in GSP per capita can be explained by the percentage of state residents with a high school diploma and above?

B. Is there a statistically significant linear relationship, at the .05 level, between GSP per capita and the percentage of state residents with any level of higher education? If there is, how much of the variance in GSP per capita can be explained by the percentage of state residents with any level of higher education?

C. Is there a statistically significant linear relationship, at the .05 level, between GSP per capita and the percentage of state residents with an associate degree and above? If there is, how much of the variance in GSP per capita can be explained by the percentage of state residents with an associate degree and above?

D. Is there a statistically significant linear relationship, at the .05 level, between GSP per capita and the percentage of state residents with a bachelor's degree and above? If there is, how much of the variance in GSP per capita can be explained by the percentage of state residents with a bachelor's degree and above?

E. Is there a statistically significant linear relationship, at the .05 level, between GSP per capita and the percentage of state residents with a graduate or professional degree? If there is, how much of the variance in GSP per capita can be explained by the percentage of state residents with a graduate or professional degree?

Method

Sample

The 50 states and District of Columbia of the United States were selected as the sample of this study. There were a total of 51 cases.

Data Collection

The data used in this study were derived from the following data:

A. Number of persons 25 years old and older, and the percentage of this group with a high school diploma, with some college but no degree, with an associate degree, with a bachelor's degree, and with a graduate or professional degree, from Digest of Education Statistics (U.S. Department of Education, 1995).

B. The state resident population (Appendix B), from Statistical Abstract of the United States, (U.S. Department of Commerce, 1995).

C. Gross state product (Appendix B), from Survey of Current Business, (U.S. Department of Commerce, 1994).

The above data were of 1990. They were the most recent available.

As far as the educational stock is concerned, the best information available was the percentage of state residents 25 years old and older with a high school diploma and above, with any level of higher education, with an associate degree and above, with a bachelor's degree and above, and with a graduate or professional degree.

The derived data used in this study are listed in Tables 1 to 6.

Table 1
Gross State Product per Capita, 1990 (in 1987 dollars)

State	GSP p.c.	State	GSP p.c.	State	GSP p.c.
Mississippi	13613	Iowa	17495	Texas	19749
West Virginia	14371	Oregon	17538	Virginia	19929
Arkansas	14565	Vermont	17870	Maryland	20109
Montana	14981	Indiana	17921	Minnesota	20226
Alabama	15591	Missouri	18010	Washington	20361
New Mexico	15814	Wisconsin	18111	Illinois	21020
Utah	15989	Michigan	18122	California	22354
Idaho	15992	Pennsylvania	18212	Massachusetts	22726
Oklahoma	15992	Rhode Island	18236	New York	22996
Kentucky	16289	Ohio	18319	Hawaii	23162
South Carolina	16318	Kansas	18528	New Jersey	23606
South Dakota	16371	North Carolina	18576	Nevada	23757
North Dakota	16491	Louisiana	18737	Wyoming	25445
Arizona	16533	Georgia	18857	Connecticut	25490
Maine	16630	Nebraska	18901	Delaware	25790
Florida	16721	New Hampshire	18940	Alaska	43276
Tennessee	17356	Colorado	19580	District of Columbia	52583

Table 2
Percentage of State Residents With a High School Diploma and Above, 1990

State	%	State	%	State	%
Mississippi	38.49	Missouri	47.49	Maryland	51.20
Kentucky	40.95	Indiana	47.66	New Jersey	51.20
Louisiana	41.07	Idaho	47.67	Iowa	51.24
Alabama	42.10	South Dakota	47.70	Hawaii	51.26
Arkansas	42.24	California	47.87	Kansas	51.33
South Carolina	42.40	Michigan	48.21	Vermont	51.33
Delaware	42.49	Virginia	48.23	Montana	51.44
West Virginia	43.06	Ohio	48.26	Nebraska	51.71
Tennessee	43.12	Illinois	48.68	Nevada	51.75
Texas	43.89	New York	49.14	Minnesota	52.22
Georgia	44.04	Arizona	49.36	Massachusetts	52.63
Utah	44.34	Pennsylvania	49.42	New Hampshire	52.84
North Carolina	44.90	Wisconsin	49.71	Connecticut	53.00
New Mexico	45.68	Wyoming	50.88	Oregon	53.13
Rhode Island	47.26	Alaska	50.91	Washington	53.77
Oklahoma	47.33	Florida	51.11	Colorado	53.98
North Dakota	47.42	Maine	51.14	District of Columbia	57.17

Table 3
Percentage of State Residents With Any Level of Higher Education, 1990

State	%	State	%	State	%
West Virginia	19.13	Maine	27.12	Kansas	30.59
Kentucky	20.83	Michigan	27.91	Wyoming	30.62
Arkansas	21.44	Rhode Island	27.92	Nevada	31.03
Louisiana	22.01	Oklahoma	27.97	Virginia	31.15
Mississippi	22.06	New Mexico	28.18	Minnesota	31.33
Alabama	23.56	Texas	28.35	New Hampshire	32.46
Indiana	23.61	Delaware	28.83	Hawaii	32.85
Tennessee	23.81	Vermont	29.31	Maryland	32.86
Pennsylvania	23.85	Idaho	29.49	Arizona	32.96
South Carolina	24.07	Illinois	29.54	Massaehusetts	33.06
Ohio	25.09	New York	29.76	Connecticut	33.25
Georgia	25.66	Nebraska	29.78	California	33.86
Missouri	26.19	North Dakota	30.05	Alaska	34.00
Wisconsin	26.25	Montana	30.16	Oregon	34.27
North Carolina	26.30	Utah	30.18	District of Columbia	35.09
Iowa	26.61	New Jersey	30.41	Washington	35.85
South Dakota	26.87	Florida	30.43	Colorado	37.04

Table 4
Percentage of State Residents With an Associate Degree and Above, 1990

State	%	State	%	State	%
West Virginia	10.49	Pennsylvania	15.30	Oregon	17.95
Arkansas	10.89	New Mexico	15.45	Delaware	18.02
Kentucky	11.20	North Carolina	15.52	Rhode Island	18.05
Louisiana	11.68	Texas	15.54	Virginia	19.28
Mississippi	11.96	Utah	15.67	Minnesota	19.31
Tennessee	12.92	Wisconsin	15.68	New York	19.44
Alabama	12.97	Iowa	15.74	California	19.67
Indiana	13.17	Wyoming	15.86	Washington	19.79
Nevada	14.06	Montana	16.15	Vermont	19.89
Ohio	14.23	Nebraska	16.48	Hawaii	19.95
South Carolina	14.26	Maine	16.69	New Jersey	20.05
Missouri	14.34	Kansas	16.75	Maryland	20.71
Oklahoma	14.46	Arizona	17.03	New Hampshire	20.83
Idaho	15.00	Florida	17.10	Colorado	21.68
Michigan	15.08	Illinois	17.16	Connecticut	22.60
Georgia	15.10	North Dakota	17.37	Massachusetts	22.66
South Dakota	15.23	Alaska	17.82	District of Columbia	24.55

Table 5
Percentage of State Residents With a Bachelor's Degree and Above, 1990

State	%	State	%	State	%
West Virginia	8.03	North Dakota	11.27	Alaska	13.64
Arkansas	8.51	Oklahoma	11.28	Delaware	13.81
Kentucky	8.60	Missouri	11.45	Minnesota	13.87
Mississippi	8.82	Wyoming	11.45	Rhode Island	13.96
Louisiana	9.67	Utah	11.55	Hawaii	14.62
Indiana	9.81	Pennsylvania	11.87	California	14.70
Alabama	9.83	Nebraska	11.98	Washington	14.71
Nevada	10.07	Georgia	11.98	New York	15.17
Tennessee	10.25	Maine	12.21	Vermont	15.45
South Carolina	10.33	Texas	12.38	New Hampshire	15.60
Idaho	10.63	New Mexico	12.48	Virginia	15.74
South Dakota	10.63	Florida	12.57	New Jersey	16.58
Iowa	10.80	Montana	12.64	Colorado	17.27
Ohio	10.86	Arizona	12.74	Maryland	17.30
Michigan	10.88	Kansas	13.36	Massachusetts	17.92
North Carolina	11.16	Oregon	13.44	Connecticut	18.19
Wisconsin	11.18	Illinois	13.46	District of Columbia	22.41

Table 6
Percentage of State Residents With a Graduate or Professional Degree, 1990

State	%	State	%	State	%
North Dakota	2.82	Montana	3.63	Oregon	4.57
Arkansas	2.85	Nebraska	3.74	Alaska	4.73
South Dakota	3.02	Ohio	3.77	Illinois	4.79
Mississippi	3.03	Oklahoma	3.81	Delaware	4.95
West Virginia	3.12	Missouri	3.93	New Hampshire	5.05
Idaho	3.18	Texas	3.94	New Mexico	5.08
Iowa	3.31	Georgia	3.97	Rhode Island	5.08
South Carolina	3.36	Maine	3.99	California	5.09
Louisiana	3.36	Minnesota	4.00	Vermont	5.68
Nevada	3.41	Indiana	4.02	Colorado	5.77
Alabama	3.47	Michigan	4.02	Virginia	5.85
North Carolina	3.47	Florida	4.33	New Jersey	5.89
Kentucky	3.47	Pennsylvania	4.38	New York	6.50
Tennessee	3.49	Arizona	4.39	Massachusetts	6.98
Wyoming	3.52	Kansas	4.44	Maryland	7.11
Wisconsin	3.54	Washington	4.50	Connecticut	7.36
Utah	3.54	Hawaii	4.51	District of Columbia	11.53

Data Analysis

A series of multiple linear regression analyses were used to investigate the data. The gross state product per capita was used as the dependent variable. Used as the independent variables were: (a) the percentage of state residents with a high school diploma and above, (b) the percentage of state residents with any level of higher education, (c) the percentage of state residents with an associate degree and above, (d) the percentage of state residents with a bachelor's degree and above, and (e) the percentage of state residents with a graduate or professional degree.

Before the multiple linear regression was run, all requirement and assumptions for the regression analysis were checked, and they were all satisfied.

Results

The results of the multiple regression analyses are presented in Table 7:

Table 7
Multiple Regression: GSP per Capita With the Percentage of State Residents With Different Levels of Education

Regression	Adjusted R Square	Significant F
GSP per capita with the percentage of state residents with a high school diploma and above	.18712	.0009
GSP per capita with the percentage of state residents with any level of higher education	.21455	.0011
GSP per capita with the percentage of state residents with an associate degree and above	25174	.0008
GSP per capita with the percentage of state residents with a bachelor's degree and above	.39660	.0000
GSP per capita with the percentage of state residents with a graduate or professional degree	.49843	.0000

The results shown in Table 7 indicate that there is a significant linear relationship, at the .05 level, between GSP per capita and the percentage of state residents with a high school diploma and above, between GSP per capita and the percentage of state residents with any level of higher education, between GSP per capita and the percentage of state residents with an associate degree and above, between GSP per capita and the percentage of state residents with a bachelor's degree and above, and between GSP per capita and the percentage of state residents with a graduate or professional degree. The results of the multiple linear regression analyses also indicate: (a) about 19% of the variance in GSP per capita can be explained by the percentage of state residents with a high school diploma and above, (b) about 21% of the variance in GSP per capita can be explained by the percentage of state residents with any level of higher education, (c) about 25% of the variance in GSP per capita can be explained by the percentage of state residents with an associate degree and above, (d) about 40% of the variance in GSP per capita can be explained by the percentage of state residents with a bachelor's degree and above, and (e) about 50% of the variance in GSP per capita can be explained by the percentage of state residents with a graduate or professional degree.

There is a pattern in the results of this study: The percentage of state residents with progressively higher levels of education can explain a progressively larger percent of the variance in GSP per capita.

Limitations

The ecological generalizability of this study may be limited. The ecological generalizability refers to the extent to which the findings of a particular study can be generalized beyond the settings used in the study (Wallen & Fraenkel, 1991).

This study investigated the strength of the relationship between educational stock and economic output in the United States. The economic conditions in different countries are not the same, and the economic development of the world is not balanced. The United States may be representative of some developed countries, but not all countries in the world, in terms of economic conditions.

Discussion

The results of this study may have several implications. First, college-educated people may be more productive than high school graduates. Second,

people with higher levels of education may become more productive than people with lower levels of education. Third, education, as a form of human capital embodied in the work force, may contribute a fairly large part to economic output.

Why could the college-educated be more productive than high school graduates? Why could people with higher levels of education become more productive than people with lower levels of education? What are the implications for policy-makers, employers, and parents? This section will focus on these issues.

Education and Productivity

Why could the college-educated be more productive than high school graduates? Or to put it another way, what could college do to make its students more productive than high school graduates? On this issue many scholars have presented their views, and there is much in common in their views.

Keniston and Gerzon (1971) argued that there are two components of education that have major effects upon students: (a) the technical component, and (b) the critical component. According to Keniston and Gerzon, the technical component of education focuses mainly on preparing students to become economically productive citizens; the aim of the technical component of education is to transmit a body of knowledge in order to enable students to apply it productively to technical problems. The critical component of education, they noted, tries to stimulate students to test and challenge their previously unexamined assumptions; the aim of the critical component is to increase open-mindedness, the individualization of moral judgements, and psychological autonomy and independence.

The technical component of education presented by Keniston and Gerzon seems to be more related to productivity than the critical component does. Keniston and Gerzon, however, maintained that the critical component is as important as the technical one. They emphasized that the critical component of education "strives to create conditions which stimulate students' intellectual, moral, and emotional growth, so that they may ground their skills in a more mature, humane framework of values" (p. 52).

Bowen (1978) noted that college greatly enhances the practical competence of its students. According to Bowen, college helps students

develop skills and traits of general applicability such as substantive knowledge, a rational approach to problems, intellectual tolerance, and adaptability. He stated that college-educated people have greater allocative ability--"ability to adjust promptly and appropriately to changing economic demands, technologies, and resources" (p. 434).

Bowen's view on college's influence upon its students is quite similar to that of Keniston and Gerzon. They all emphasize two effects that college has upon its students. One is the technical effect, and the other is the liberalizing effect.

Other scholars, such as McMahon (1987) and Davis and Morrall (1974), had similar views to those presented above. They maintained that both the technical effect and liberalizing effect are necessary components of education for preparing students to become productive workers.

According to human capital theory, education is one of the major forms of human capital that can be embodied in people--in scientists, scholars, managers, technicians, and others. Educated people have the potential to apply the knowledge they have acquired, and the application of knowledge can increase productivity.

Many would acknowledge that advances in science and technology have become a major source of economic growth. Advances in science and technology are often made through research breakthroughs or organizational and technological inventions and innovations. Higher educational institutions are one of the major places where research is carried out. College students participate in research at school, and they are potential inventors and innovation- makers after graduation. College not only provides its students with the opportunity to acquire knowledge but also enhances their intellectual, psychological, and emotional maturity. Maybe just by doing so, college prepares its students to become productive workers, and the more education they receive, the more productive they may become.

Insights From the Results

The results of this study imply that people with higher levels of education may become more productive than people with lower levels of education. The results of this study also imply that education, as a major form of human capital embodied in the work force, may contribute a fairly

large part to economic output. What could these implications mean to such persons as policy-makers, employers, and parents?

Being more productive may mean creating more value. Part of the value created may go to individual workers as private return, part may go to the public purse as social return, and part may go to employers as profit. If people with higher levels of education are more productive than people with lower levels of education, education may benefit not only educated employees and their employers, but also society at large.

If education benefits both educated individuals and the whole society, what policies are needed in order to enlarge the educational stock? This issue can be viewed from several angles. First, if education contributes a fairly large part to economic output, a fairly large amount of resources should be allocated to the enterprise of education. Financial security is necessary for the enterprise to develop. Second, it may be a wiser policy to enlarge educational stock by increasing the educational level of average citizens than by increasing the educational level of a limited few. The higher the educational level of average citizens is, the bigger the economic pie may become. Third, if education helps the poor get rid of poverty, it may be instrumental in reducing the unequal distribution of personal income among individuals. It may be wiser to help the poor by teaching them how to fish than by giving them some fish.

If education raises productivity and bring profit to employers, what should employers do in order to get the profit? There may be at least two things that employers should consider.

First, encouraging and helping employees to further their education may be one of the effective ways to enlarge the educational stock of their businesses. According to McMahon (1987), education can enhance the productivity, flexibility, and adaptability of educated people, and furthermore, the productivity, flexibility, and adaptability of educated employees can enhance the productivity of other employees in the workplace.

Second, it may be wiser to try to attract educated people than try to "possess" them. In fact, unlike physical capital, human capital cannot be possessed. It is embodied in human beings. If your business does not attract educated people, they will migrate to a more attractive place. Market competition, in a sense, may finally become competition for educated people.

If education brings private returns to individuals, investment in children's education may mean investment in their future. In order to let their children have a bright future, parents need to try to help their children with their education. School years may be one of the critical periods in which help is most needed. Students need financial, emotional, and psychological help from parents. Without parents' help, some students might fail at school.

Another issue related to parents' support of children's education is family planning. Becker (1993) noted that the number of children and spending on education per child tend to be negatively related: Smaller families generally spend more on their children's education than do larger families. One explanation for the negative relationship between the number of children and spending on education per child may be that larger families cannot afford to spend as much on their children's education as smaller families. Family planning, therefore, may have some impact on children's education.

Conclusion

This study investigated the relationship between education and the economy by regressing the gross state product per capita with the percentage of state residents with different levels of education. The results of this study are congruent with human capital theory: If the more educated are more productive than the less educated, a population with a larger educational stock should be more productive than the population with a smaller educational stock.

The results of this study are also congruent with the results of many studies that employed other approaches to investigate the relationship between education and the economy. It may be logical that if individuals with higher levels of education earn more than those with lower levels of education, if education explains a large part of the residual variance in economic growth, and if the rate of return to education is above the 10% common yardstick of the opportunity cost of capital, the percentage of state residents with higher levels of education could explain a larger percent of the variance in GSP per capita than the percentage of state residents with lower levels of education.

This study focused on the impact of education on the economy. It, however, does not imply that the economy has no impact on education, or that the study of the impact of the economy on education is not so important. Many scholars have pointed out that there is a mutual effect between

education and the economy, and many have been studying the effect of the economy on education. Findings from studies of both impacts may help clarify the relationship between education and the economy.

Recommendation

The sample of this study consists of the 50 states plus the District of Columbia of the United States. The United States is a developed country. Further studies may select less developed countries as samples. High school and college education may have a stronger or weaker impact on the economies of less developed countries than they do on the economy of the United States.

Counted as educational stock in this study were high school and college education. Further studies may focus on the relationship between lower levels of education and the economy. Lower levels of education may play a more important role in the economic development in some countries than in others.

The data for this study were of 1990. Further studies may use data of earlier years. Different levels of education may have stronger or weaker impact on the economy in different stages of economic development.

This study was done without dealing with the factors of production. The factor endowment may be different from state to state, and each state may have its own key industries. Further studies may concentrate on the relationship between educational stock and the output in different industries such as agriculture, construction, manufacturing, transportation, finance, and services.

Surely there must be some practical limits to the benefits of education as measured by gross state product. Further research is needed to determine those practical limits.

Reference

Becker, G. S. (1993). Human capital (3rd ed.). Chicago: The University of Chicago Press.

Bowen, H. R. (1978). Investment in learning. San Francisco: Jossey-Bass Publishers.

Cohn, E. (1975). The economics of education. Cambridge, Mass.: Ballinger Publishing Company.

Cohn, E., & Geske, T. G. (1990). The economics of education (3rd ed.). New York: Pergamon Press.

Davis, J. R., & Morrall III, J. F. (1974). Evaluating educational investment. Lexington, Mass.: D. C. Heath and Company.

DeYoung, A. J. (1989). Economics and American education. New York: Longman Inc.

Keniston, K., & Gerzon, M. (1972). Human and social benefits. In L. Wilson & O. Mills (Eds.), Universal higher education. Washington, D. C.: American Council on Education.

McMahon, W. W. (1987). Externalities in education. In G. Psacharopoulos (Ed.), Economics of education: Researches and studies. New York: Pergamon Press.

Merrett, S. (1971). The rate of return to education: A critique. In R. A. Wykstra (Ed.), Education and the economics of human capital. New York: The Free Press.

Psacharopoulos, G. (1981). Returns to education: An updated international comparison. Comparative Education, 17 (3), 321-341.

Schultz, T. W. (1971). Investment in human capital. In R. A. Wykstra (Ed.), Education and the economics of human capital. New York: The Free Press.

Schultz, T. W. (1971). Investment in human capital: The role of education and of research. New York: The Free Press.

Solmon, L. C. (1987). The range of educational benefits. In G. Psacharopoulos (Ed.), Economics of education: Researches and studies. New York: Pergamon Press.

U. S. Department of Commerce. (1994). Statistical abstract of the United States. Washington, D. C.

U. S. Department of Commerce. (1995). Statistical abstract of the United States. Washington, D. C.

U. S. Department of Commerce. (1994). Survey of current business. Washington, D. C.

U. S. Department of Education. (1995). Digest of education statistics. Washington, D. C.

Wallen, N. E., & Fraenkel, J. R. (1991). Educational research: A guide to the process. New York: McGraw-Hill, Inc.

Weisbrod, B. A. (1971). Investing in human capital. In R. A. Wykstra (Ed.), Education and the economics of human capital. New York: The Free Press.

Woodhall, M. (1987). Cost analysis in education. In G. Psacharopoulos (Ed.), Economics of education: Researches and studies. New York: Pergamon Press.

Woodhall, M. (1987). Economics of education: A review. In G. Psacharopoulos (Ed.), Economics of education: Researches and studies. New York: Pergamon Press.

Woodhall, M. (1987). Human capital concepts. In G. Psacharopoulos (Ed.), Economics of education: Researches and studies. New York: Pergamon Press.

Wykstra, R. A. (1971). Introduction. In R. A. Wykstra (Ed.), Education and the economics of human capital. New York: The Free Press.